Watershed Program Annual Report

FY 2004

Photo of Bacon Creek courtesy of Aimee Fullerton

Introduction

The mission of the Watershed Program is to conduct research on physical and biological processes that influence aquatic ecosystems in the Pacific Northwest, effects of land management on those ecosystems, and ensuing effects on the health and productivity of anadromous fish populations and their habitats. We provide technical support to NOAA Fisheries policy makers and regulatory staff, and collaborate with other agencies, tribes, and educational institutions on research and education related to the management of Pacific salmon. Program activities are driven by two broad goals that focus on our mission:

1. Advance the research outlined in our Strategic Research Plan, and
2. Support Technical Recovery Teams and the Regional Office in administering the Endangered Species Act.

Research activities of the Program are guided by the Watershed Program Strategic Research Plan (available at http://www.nwfsc.noaa.gov/research/divisions/ec/wpg/index.cfm). The Strategic Research Plan outlines four primary research themes: 1) landscape analyses and assessments to assist with recovery planning for listed species, 2) fish responses to changes in habitat, watershed or ecosystem conditions, 3) effects of natural or human disturbance on watershed processes and habitat conditions, and 4) effectiveness monitoring of habitat and watershed restoration strategies or techniques. Within these themes, the plan highlights a number of priority research topics and projects (Table 1). In addition to the Strategic Research Plan, an independent panel of scientists reviewed our research plan and activities, and suggested a number of potential improvements. Following these reviews we set several additional goals for the Program, including:

- Monitor progress on our research plan,
- Expand research collaborations both within and outside the center, and
- Broaden our research beyond the region and salmon science.

The following report briefly summarizes progress on each of these goals, as well as details of progress on our research plan, and a summary of Program expenditures. The report was prepared to assist Watershed Program staff and NWFSC leadership in tracking and documenting our progress on our research goals.

Annual report

Staff

In FY 2004 the Program included 15 full-time federal staff members with expertise in fish biology, stream ecology, riparian ecology, landscape ecology, geomorphology, statistics, and population dynamics, as well as 14 post-docs, interns, contractors, and part-time staff.

Accomplishing Program goals

The Watershed Program made significant progress on each of the goals set for FY 2004 (Table 2), most notably maintaining a strong record of publishing and presenting research findings. With 100 presentations (Table 3) and 33 publications (Appendix 1) during the year, the

Watershed Program established itself as one of the most productive watershed research groups in the Pacific Northwest. At the same time, the Program maintained a strong commitment to science support for the Regional Office and salmon restoration groups throughout the region. The Program plays a lead role in habitat restoration planning efforts of the Technical Recovery Teams, conducts scientific reviews and analyses to support the Regional Office, and publishes guidance reports such as Ecosystem Recovery Planning for Listed Salmon.

The Program also began processes to monitor progress on our research objectives, mainly through the continued use of monthly staff updates and the institution of a new annual reporting procedure. The Program also began a longer-term effort to expand our research beyond the Pacific Northwest and salmon science, establishing new working relationships with the University of Washington Climate Impacts Group, Western Washington University, and co-founding the Coastal Rivers Research Consortium (University of Washington, the U.S. Geological Survey, U.S. National Park Service, U.S. Forest Service, and Weyerhaeuser Company). The Program also initiated a review of stream restoration techniques with the U.N. Food and Agriculture Organization, as well as research exchanges with the Great Basin Ecosystem Management Project (central Nevada) and river scientists in Austria, the UK, Mongolia, and Russia. Through these efforts we hope to broaden the scope and utility of our contributions to the science and management of aquatic ecosystems.

The Watershed Program also continues a substantial program of outreach activities, including educational programs at local schools, guest lectures at universities, and serving on advisory committees of graduate students. Members of the Program participate as trainers in regional workshops (e.g., planning and prioritizing stream restoration), serve on science advisory boards (e.g., UW Center for Water and Watershed Studies), and serve on technical review panels for salmon recovery efforts (e.g., reviewed local watershed restoration plans for the Puget Sound TRT).

Research progress

We made significant progress on the components of our research plan. One book, one project report, and 7 research articles were published from planned projects. Another 13 articles are in preparation or in review. Ten projects are continuing field work and data analysis prior to manuscript preparation. Of the nine projects remaining, three are planned to begin in FY05 and six remain unfunded with no plans for startup in FY05.

Finances

Watershed Program Expenditures in FY 2004 were clearly focused on accomplishing our research priorities and supporting the Regional Office, with most funds going to research staff. An additional 32 percent of our funds support field studies (technicians, travel, equipment, and sampling costs), sample processing, and data analysis. Approximately 4 percent of our budget was focused on communicating our research findings to local, regional, national, and international scientific communities.

Watershed Program goals for FY 2005

The Watershed Program has identified eight goals for FY 2005, three of which are permanent goals that must be met each year. The continuing goals are:

1. Advance the research outlined in our Strategic Research Plan,
2. Support Technical Recovery Teams and the Regional Office in administering the Endangered Species Act, and
3. Monitor progress on our research plan.

Additional goals that focus on steps the Program should take in FY 2005 are:

4. Increase integration across teams within the Program,
5. Increase levels of external funding,
6. Continue to broaden our research and collaborations beyond the region and salmon science,
7. Continue a significant outreach program, and
8. Plan an Open House for October 2005.

Table 1. Primary research objectives of the Watershed Program Research Teams

Landscape Ecology and Recovery Science Team

- Broad-scale relationships among land uses and fish populations
- Appropriate uses of remotely sensed and modeled data
- Impacts of non-indigenous species on salmon recovery

Fish-Habitat Relationships Team

- Development of habitat-based salmon life-cycle models
- Quantifying stage-to-stage survivals for salmonids in freshwater and estuaries
- Influences of spatial structure (habitat and population) on population responses to habitat change
- Effects of changes in habitat quality on salmonid abundance and survival

Natural Processes and Human Disturbance Team

- Effects of urban and agricultural development on stream ecosystems
- Lowland river ecology: effects of dams, land use, and channel controls on large river ecosystems and salmon populations
- Watershed-scale management practices and cumulative effects
- Effects of watershed processes and land uses on biological diversity
- Influence of nutrients and light on stream ecosystems

Restoration Team

- Restoration of large rivers: influence of engineered logjams in large rivers on primary production and fish response
- Floodplain restoration: comparison of natural to constructed floodplain channels
- Dam removal: effects of changing sediment supply on habitat and biota
- Small stream restoration: effects of wood and boulder placement on habitat and biota
- Effects of restoration at a watershed scale

Table 2. Summary of progress on Program Goals for FY 2004

Goal 1: Advance planned research and monitor progress

- 33 articles, books, book chapters, and reports published or in press (Appendix 1)
- 100 presentations, 27 of which were at national and regional scientific meetings
- Significant progress (e.g., data collection, analysis) on field studies, laboratory studies, and GIS/data analysis

Goal 2: Support salmon recovery efforts of the Regional Office and Technical Recovery Teams

- Published 'Ecosystem Recovery Planning for Listed Salmon' (guidance for habitat restoration planning)
- Led habitat analyses for Willamette Lower Columbia TRT (contributing to numerous research reports and publications)
- Collaborated with center scientists in Puget Sound TRT research (contributing to 6 research reports and publications)
- Completed AFS guidance book on monitoring stream and watershed restoration
- Led habitat analyses for FCRPS Biological Opinion Remand (4 publications in preparation)
- Led critical review of stream temperature for NOAA Fisheries Regional Office (RO)
- Consulted with RO on numerous technical issues

Goal 3: Monitor research progress

- Implemented annual reporting process to track research progress

Goal 4: Expand research collaborations

- Continued strong research collaborations with agencies, tribes, and universities
- Initiated new research collaborations with UW Climate Impacts Group, Western Washington University, and Coastal Rivers Research Consortium (NOAA, USGS, USNPS, USFS, University of Washington)
- Continued strong research collaborations within the Center (currently working with more than 20 Center scientists in other programs and divisions)

Goal 5: Expand research beyond the region and salmon science

- Began working with the UN to review stream restoration techniques worldwide
- Began research exchanges with the Great basin Ecosystem Management Project (Central Nevada) and counterparts in Russia and Mongolia

Table 3. Summary of presentations by forum and topic area for each research team.

	Landscape Ecology and Recovery Science	Natural Processes and Human Disturbance	Fish-Habitat Relationships	Restoration	Program Total (all teams)
Professional meeting	7	10	4	6	27
Outreach	8	13	5	6	32
Workshop	6	4	3	3	16
University	3	2	1	2	8
Other	3	2	3	9	17

Appendix 1. Watershed Program Publications

Beamer, E.M., **T.J. Beechie**, B.S. Perkowski, and J.R. Klochak. 2003. Restoration of habitat forming processes: an applied restoration strategy for the Skagit River. Pages 157-183 in Beechie, T.J., E.A. Steel, P.R. Roni, and E. Quimby, editors. Ecosystem recovery planning for listed salmon: an integrated assessment approach. U.S. Dept. Commerce, NOAA Technical Memorandum, NMFS-NWFSC-58, 183 p.

Bechmann, R.K., I.C. Taban, G. Jonsson, S. Sanni, **W.L. Reichert**, S. Plisson-Saune, and M. Buffagni. (2004). Bioaccumulation, biomarker responses, and effects on reproduction in fish exposed to a mixture of PAHs (polycyclic aromatic hydrocarbons) and to dispersed oil. The Seventh SPE International Conference on Health, Safety, and Environment in Oil and Gas Exploration and Production, Calgary, Alberta, Canada, Society of Petroleum Engineers.

Beechie, T.J. 2003. An assessment approach for habitat recovery planning. Pages 5-17 in Beechie, T.J., E.A. Steel, P.R. Roni, and E. Quimby, editors. Ecosystem recovery planning for listed salmon: an integrated assessment approach for salmon habitat. U.S. Dept. Commerce, NOAA Technical Memorandum, NMFS-NWFSC-58, 183 p.

Beechie, T.J., C.N. Veldhuisen, D.E. Schuett-Hames, P. DeVries, R.H. Conrad, and E.M. Beamer. In press. Monitoring treatments to reduce sediment and hydrologic effects from roads. In P. Roni, editor. Methods for monitoring stream and watershed restoration.

Beechie, T.J., E.A. Steel, P.R. Roni, and E. Quimby, editors. 2003. Ecosystem recovery planning for listed salmon: an integrated assessment approach for salmon habitat. U.S. Dept. Commerce, NOAA Technical Memorandum, NMFS-NWFSC-58, 183 p.

Benda, L., L. Poff, D. Miller, T. Dunne, G. Reeves, **G. Pess**, and **M. Pollock**. 2004. Network disturbance theory: landscape and river organization of environmental variance. Bioscience. 54:413-427

Bilby, B.E., **T.R. Bennett,** and **P. Roni**. In review. Contribution of nitrogen from spawning salmon to juvenile chinook salmon and steelhead in the Columbia River basin. North American Journal of Fisheries Management.

Booth, D.B., J.R. Karr, S. Schauman, C.P. Konrad, **S.A. Morley**, M.G. Larson, and S.J. Burges. In press. Reviving urban streams: land use, hydrology, biology, and human behavior. Journal of the American Water Resources Association.

Feist, B.E., E.A. Steel, G.R. Pess, and R.E. Bilby. 2003. The influence of scale on salmon habitat restoration priorities. Animal Conservation 6: 271-282

Greene, C.M., and T.J. Beechie. 2004. Consequences of potential density-dependent mechanisms on recovery of ocean-type Chinook salmon (Oncorhynchus tshawytscha). Canadian Journal of Fisheries and Aquatic Sciences.

Greene, C.M. 2003. Habitat selection reduces extinction of populations subject to Allee effects. Theoretical Population Biology, 64:1-10

Hyatt, T. L., T.Z. Waldo, and **T.J. Beechie.** In press. A watershed-scale assessment of riparian forests, with implications for restoration. Restoration Ecology.

Kiffney, P.M., J.S. Richardson, and J.P. Bull. In press. Establishing light as a causal mechanism structuring stream communities in response to experimental manipulation of riparian buffer width. Journal of the North American Benthological Society.

Kiffney, P.M., C. Volk, **T. Beechie**, G. Murray, **G. Pess**, and R. Edmonds. In press. A rare disturbance event alters community and ecosystem properties in West Twin Creek, Olympic National Park, Washington. American Midland Naturalist.

Kiffney, P.M., R.E. Bilby, and **B. Sanderson.** In press. Monitoring the effects of nutrient enrichment on freshwater ecosystems. In Monitoring stream and watershed restoration, P. Roni, editor. American Fisheries Society.

Liermann, M., E.A. Steel, M. Rosing, and P. Guttorp. 2004. Random denominators and the analysis of ratio data. Journal of Environmental and Ecological Statistics 11:55-71.

Medina, A.L., **P. Roni**, and J.N. Rinne. In press. Riparian restoration through grazing management: considerations for monitoring project effectiveness. Pages xx to xx in P. Roni, editor. Monitoring stream and watershed restoration. American Fisheries Society, Bethesda, Maryland.

Pess, G., P. Roni, and S. Morley. In press. Evaluating fish response to culvert replacement and other methods for reconnecting isolated aquatic habitats. Pages xx to xx in P. Roni, editor. Monitoring stream and watershed restoration. American Fisheries Society, Bethesda, Maryland.

Pess, G.R., T.J. Beechie, J.E. Williams, D.R. Whitall, J.I. Lange, and J.R. Klochak. 2003. Chapter 8. Watershed assessment techniques and the success of aquatic restoration activities. Pages 185-201 in R.C. Wissmar and P.A. Bisson, editors, Strategies for Restoring River Ecosystems: Sources of Variability and Uncertainty in Natural and Managed Systems. American Fisheries Society, Bethesda, Maryland.

Pess, G.R., T.J. Beechie, S.A. Morley, and E.M. Beamer. 2003. Analyses for Phase II recovery planning: identifying ecosystem restoration actions. Pages 40-59 in Beechie, T.J., E.A. Steel, P.R. Roni, and E. Quimby, editors. Ecosystem recovery planning for listed salmon: an integrated assessment approach for salmon habitat. U.S. Dept. Commerce, NOAA Technical Memorandum, NMFS-NWFSC-58, 183 p.

Pinkney, A.E., J.C. Harshbarger, E.B. May, **W.L. Reichert**. 2004. "Tumor Prevalence and Biomarkers of Exposure and Response in Brown Bullheads (Ameiurus nebulosus) from the Anacostia River, Washington, DC and Tuckahoe River, Maryland, USA." Environmental Toxicology and Chemistry 23(3): 638-647.

Pollock, M.M., G.R. Pess, T.J. Beechie, and D.R. Montgomery. In press. The importance of beaver ponds to coho salmon production in the Stillaguamish River basin, Washington, USA. North American Journal of Fisheries Management.

Pollock, M.M., T.J. Beechie, S. Chan, and R. Bigley. In press. Monitoring and evaluating riparian restoration efforts. In P. Roni, editor. Methods for monitoring stream and watershed restoration.

Rice, C.A., W.G. Hood, L.M. Tear, C.A. Simenstad, L.L. Johnson, G.D. Williams, **P. Roni, and B.E. Feist**. In press. Pages xx to xx in P. Roni, editor. Monitoring stream and watershed restoration. American Fisheries Society, Bethesda, Maryland.

Roni, P., T. Beechie, and G. Pess. 2004. Prioritizing restoration actions within watersheds. Pages 60 to 73 in Beechie, T., E.A. Steel, and P. Roni. 2004. Ecosystem Recovery Planning for Listed Salmon: An Integrated Assessment Approach for Salmon Habitat. NOAA Technical Memorandum NMFS-NWFSC-58, Seattle, Washington.

Roni, P. (editor). In press. Monitoring stream and watershed restoration. American Fisheries Society, Bethesda, Maryland.

Roni, P. 2003. Responses of benthic fishes and giant salamanders to placement of large woody debris in small Pacific Northwest streams. North American Journal of Fisheries Management 23:1087-1097.

Roni, P., A.H. Fayram, and M.A. Miller. In press. Monitoring and evaluating instream habitat enhancement. Pages xx to xx in P. Roni, editor. Monitoring stream and watershed restoration. American Fisheries Society, Bethesda, Maryland.

Roni, P., M.C. Liermann, C. Jordan, **E.A. Steel**. In press. Steps for designing a monitoring and evaluation program for aquatic restoration. Pages xx to xx in P. Roni, editor. Monitoring stream and watershed restoration. American Fisheries Society, Bethesda, Maryland.

Sanderson, B.L., E.A. Steel, T.J. Beechie, G.R. Pess, M.B. Sheer, and C.A. Campbell. 2003. Analyses for Phase I recovery planning: setting recovery goals. Pages 18-39 in Beechie, T.J., E.A. Steel, P.R. Roni, and E. Quimby, editors. Ecosystem recovery planning for listed salmon: an integrated assessment approach for salmon habitat. U.S. Dept. Commerce, NOAA Technical Memorandum, NMFS-NWFSC-58, 183 p.

Steel, E.A., B.E. Feist, D. Jensen, **G.R. Pess**, M. Sheer, J. Brauner, and R.E. Bilby. 2004. Landscape models to understand steelhead (Oncorhynchus mykiss) distribution and help prioritize barrier removals in the Willamette basin, OR, U.S.A. Canadian Journal of Fisheries and Aquatic Sciences 61: 999-1011.

Steel, E.A., K.A. Kelsey, J. Morita. 2004. The Truth about Science: A middle school curriculum teaching the scientific method. Journal for Environmental and Ecological Statistics 11:21-29.

Steel, E.A., L. Johnston, **B.E. Feist, G.R. Pess**, D. Jensen, R.E. Bilby, **T.J. Beechie**, and J.M. Myers. 2003. Pacific salmon recovery planning and the salmonid watershed analysis model (SWAM): A broad-scale tool for assisting in the development of habitat recovery plans. Update 20: 3-13.